

# **METHOD AND APPARATUS FOR AUTOMATICALLY PRODUCING EFFICIENT CODE FOR COMPUTING DERIVATIVES**

## **ABSTRACT**

One embodiment of the present invention provides a system that automatically computes a derivative of a numerical expression within a digital computer system. The system operates by receiving a representation of the numerical expression, wherein the numerical expression includes one or more independent variables. Next, the system forms an expression tree for the derivative of the numerical expression with respect to an independent variable, wherein the expression tree makes use of temporary variables to form results of sub-expressions for computing the derivative. While forming this expression tree, the system seeks to introduce only temporary variables and associated sub-expressions as necessary to eliminate repeated common sub-expressions, thereby substantially minimizing the number of temporary variables. The system subsequently uses this expression tree to compute the derivative of the numerical expression during a computation.